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*A pleasant day,*  
*A tree,*  
*How much is it ?*  
*It is too dear,*  
*Partridge,*  
*A fox,*  
*It is going to clear,*  
*Pretty,*  
*A basket,*  
*Blue,*  
*Green,*  
*Yellow,*  
*Red,*  
*Black,*  
*White,*  
*Small,*  
*Big,*  
*A fly,*  
*A big species of seal,*  
*A bee,*  
*Beads,*  
*Mother,*  
*A friend,*  
*Are you asleep ?*  
*Not at all (no thanks needed),*  
*Go on, continue.*  
*All right,*  
*Salmon,*  
*Cool,*  
*Devils,*

Wūlges kat  
 Habbāsy.  
 Tanīlāwādo ?  
 Sam a wārdō.  
 Pārkaŷsuch.  
 Unkwisis.  
 Bākūsāo.  
 Wūlinā gwot.  
 Abāsāmodā.  
 Wūlawīguk.  
 Skāskwīguk.  
 Wisawīguk.  
 Māk wīguk.  
 Pkāsāwegun.  
 Wābegun.  
 Pīyousessoeh.  
 Psīgain.  
 Ūjarwass.  
 Lewār̄k.  
 Wāhwillamūak.  
 Nunpkewarna.  
 Nikowuss.  
 Nītowba.  
 Kowykia ?  
 Dākāgwey.  
 Nikūnaksā.  
 Ūlīgūn.  
 Spawmuk.  
 Nūkāmuk.  
 Mātahāntūk.

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*Supplementary remarks to the Grammar of the Cakchiquel Language of Guatemala, edited by D. G. Brinton, M. D. By Otto Stoll, M. D., of Zurich, Switzerland.*

*(Read before the American Philosophical Society, February 6, 1885.)*

Among the numerous branches of the great Maya family, the languages which form the Quiché group (the Quiché with the

Uspanteca branch, and the Cakchiquel with the nearly allied Tzutuhil) offer a peculiar interest to the comparative philologist. These idioms have undoubtedly been long ago separated from the common Maya stock and may safely be reckoned among the oldest branches of this family. We may derive this fact not only from the geographical area they occupy in our days, but also from the changes which the languages themselves have undergone in the course of time. It is to be hoped that in a few years from now the lack of sufficient materials regarding them will no longer be an obstacle to rational etymological research, and that we shall be able not only to define the differences between the Quiché languages and the classic Maya, but even to trace out the laws, according to which these differences have realized themselves.

At present, only a few hints can be given in this direction. With respect to the Cakchiquel in particular, its present stock of words seems to be formed by three different groups.

First, we find a group of words which have perpetuated themselves unchanged since the Cakchiquel became independent of the Maya. Such are the following :

<i>ah</i> , cane, grass.	<i>balam</i> , tiger.
<i>al</i> , heavy, weight.	<i>chi</i> , mouth.
<i>am</i> , spider.	<i>mam</i> , grandfather, etc.

NOTE 1: In many words the difference between Maya and Cakchiquel is no real one, but must simply be attributed to the alphabets in which the two languages are written. So are the following Maya words: *isin* younger brother, *amac* inhabitant of a great village, *bac* bone, *cux* heart, life, identical with the Cakchiquel words: *i4*, *in*, *ama*Σ, *bak*, *qux* or Σ*ux*, both in meaning and pronunciation, though different in orthography.

NOTE 2: We may range among the first group a number of words in which the Cakchiquel has added a final *y* to the Maya root as in :

MAYA: <i>ba</i> ,	mole	CAKCH: <i>bay</i> .
<i>be</i>	way, road	<i>bey</i> .
<i>chho</i>	mouse	<i>qhoy</i> .

NOTE 3: In some other instances there occurs an interchange of vowels between the two languages as in:

MAYA: <i>zinic</i>	ant	CAKCH: <i>zanic</i> .
<i>miz</i>	to sweep	<i>mez</i> .
<i>uinic</i>	man	<i>uinak</i> .
<i>cimzah</i>	to kill	<i>camizah</i> .
<i>hol</i>	the hole	<i>hul</i> , etc.

The second group is formed by words in which certain *consonants* of the Maya root change into other ones in Cakchiquel. These changes follow regular phonetic laws and bear a strong affinity to the principle of "Lautverschiebung" (Grimm's law), long ago known as an agent of most extensive application in the morphology of the Indo-germanic languages.

So the Maya *n* in many instances becomes *h* in the corresponding Cakchiquel root: the Maya *t* changes into *ch* in Cakchiquel and, as Brasseur de Bourbourg already remarked, the Maya *y* sometimes becomes *r* in Cakchiquel and its sister languages.

The following examples may serve to illustrate these changes:

A. The Maya *n* becomes *h* in Cakchiquel:

MAYA: <i>kin</i>	the sun	CAKCH: <i>xih</i> .
<i>caan</i>	sky	<i>cah</i> .
<i>can</i>	four	<i>cahi</i> .
<i>on</i>	the aguacate*	<i>oh</i> .
<i>uun</i>	paper	<i>vuh</i> .
<i>nal</i>	ear of corn	<i>hal</i> .
<i>xanab</i>	sandal	<i>xahab</i> .
<i>zinan</i>	scorpion	<i>zinah</i> .
<i>bolon</i>	nine	<i>belehé</i> (in composition <i>beleh</i> ).
<i>lahun</i>	ten	<i>lahuh</i> , etc.

B. The Maya *t* changes into *ch* in Cakchiquel:

MAYA: <i>ta</i>	obsidian	CAKCH: <i>chay</i> .
<i>te</i>	tree	<i>che</i> .
<i>tub</i>	saliva	<i>chub</i> .
<i>tuh</i>	rotten, putrid	<i>chuh</i> (pus)

\* The fruit of *Tersea gratissima*.

MAYA: <i>tun</i>	stone	CAKCH: <i>chun</i> (lime-stone).
<i>taan</i>	ashes	<i>chah.</i>
<i>tah</i>	fir-tree	<i>chah</i> , etc.

C. The Maya *y* becomes *r* in Cakchiquel :

MAYA: <i>cay</i>	fish	CAKCH: <i>car.</i>
<i>koy</i>	sperm	✂ <sup>*</sup>
<i>yax</i>	green, blue	<i>rax</i> , etc.

Future inquiries will lead us to the discovery of the strict laws which rule the etymological affinity between the various branches of the Maya family. Here I must limit myself to the above given examples which may show the reader that such phonetic laws really exist and, I may add, that a similar "Lautverschiebung" can be shown between the languages of the Mam-group on one side, and the Maya and Quiché languages on the other.

Thirdly, there remains an extensive amount of Cakchiquel roots which do not seem to bear any direct alliance to the Maya words, but to have sprung from a distinct source. Most of these roots also occur in the two remaining groups of Guatemala idioms, *i. e.* in the Pokonchi and the Mam languages. After having got better acquainted with all the languages of Maya origin, we may undoubtedly hope to reduce the number of roots which now form this third group, to a considerable extent, and to discover affinities which, at present, are hidden. We shall even be able, perhaps, to point out the elements, which previously were strange to the Maya, and form the last remains of idioms preceding the Maya invasions in Guatemala.

After these short introductory remarks I shall proceed to comment on the "Grammar of the Cakchiquel Language" with a few notes, to which I had been invited by its learned editor.

p. 7. *Introduction.* "*Cozumelguapam.*" The orthography now generally adopted in official papers and maps in Guatemala is *Cotzumalguapam*. The name is evidently of Nahuatl origin, and means, according to Buschmann,† *near the rainbow water*, from

\* ✂ is the usual word for *atole*, a beverage made of corn and sugared water.

† Buschmann, Ueber die aztekischen Ortsnamen, p. 799.

*cozamalotl*. Though this etymology does not seem entirely satisfactory, I cannot offer any better.

p. 8. "*Cakix*, the ara or *guacamalla*, *Trogon splendens*." The bird called "*cakix*" by the Indians is the *Ara macao* L. known generally by its Carib name *guacamaya*. *Trogon splendens* is a scientific synonym for the *quetzal*, *Tharomacrus mocinno* (Lall.), a bird differing widely from the ara both in shape and color.

p. 19. *Phonology*. The four new signs added to the European alphabet by some of the old writers on Cakchiquel (Parra, Flores) viz: *Ĉ*, *Ĝ*, *Ĵ*, *Ĥ* are but phonetic modifications of four corresponding signs of the common alphabet. So we get four pairs of sounds, namely:

c and *Ĵ*;  
k and *Ĉ*  
ch and *Ĥ*  
tz\* and *Ĝ*,

forming two series of consonants, the former of which represents the common letters, and the latter their respective "cut letters," which may be described as being pronounced with a shorter and more explosive sound than the corresponding common letter, and separated by a short pause from the preceding or following vowel.

p. 21. *Declension of nouns*. *vleuh*, earth, pronounce *uléuh*. In the old Spanish grammars the *v* before a consonant is always an *u*, before a vowel it has the sound of the Spanish *v*.

*yxok*. The old writers are very inconsequent in the alternate use of *y* and *i*, and the reader might be misled so as to suppose them to be two differently sounding letters. Wherever in the old grammars *y* precedes a consonant, it sounds like the common *i*, and so we write better,

<i>ixok</i>	instead of	<i>yxok</i> .
<i>ix</i>		<i>yx</i> .
<i>itzel</i>		<i>yĸel</i> , etc.

In all plurals ending with *y* with the old writers, it has always the sound of *i*, and bears the accent. In pronunciation it is separated by a short hiatus from the preceding vowel and does

\**ĸ* is simply an antiquated form of the German *tz*, and is pronounced exactly like it.

not form a diphthong *ay*, as one would believe from the old orthography. So read

<i>mebai</i>	instead of	<i>mebay.</i>
<i>ahtzeolai</i>		<i>ahtzeolay.</i>
<i>ahpitzolai</i>		<i>ahpitzolay,</i>
<i>tzatchi vinak</i>	read	<i>tzatzi vinak.</i>

p. 22. *aqual, aquala*, child, written, according to the old Spanish orthography, for *acual, acuala*. Many Indians pronounce *a4ual, a4ualá*.

p. 23. *zah* read *zak* white.

*coman* *çaman*, or *zaman* the cornfield.

*camah* *çamah* or *zamah* to work.

*chu4huh* *4hu4huh, 4hu4huhilah.*

*gix, gixalah* thorn, thorny, read *4ix 4ixalah.*

*4, echelah* ticon, a cacao-field neglected and overgrown;

most probably an error of the copyist for *4ichelah* t.

*qul (4ul)* is the "manta," the unworked cotton-cloth.

*Çu* is the "chamarra," a sort of woolen blanket used by the Indians.

p. 24. *hai* read *háy*, because here the *i* forms part of a diphthong *áy*.

*nu uh, nu uhil*, write and pronounce *nu vuh, nu vuhil* my book. If the root were simply *uh*, its combination with the possessive pronoun would be *v-uh*, and not *nu uh*.

*zac, zacil* is the orthography adopted for the pure Maya idiom. It corresponds with the Cakchiquel *zak, zakil* (also *çak, çakil*).

p. 25. *chu vih* "against me," *v-ih* means "my back," *chu vih* at my back, behind me. And so *cha vih*, behind thee (not *chahvih*).

p. 26. *chinubilvih*. Flores gives the same combination (p. 255) with the variant *chirubilvih*, within himself. He adds another one of the same meaning, formed with *cohol*, the space or distance between two things, viz.:

*chinu cohol* within myself.

*cha cohol* within thyself.

*chu cohol.*

*chika cohol.*

*chi cohól.*

*chiqui cohól.*

*viquin.* More consistent with the real pronunciation is Flores' orthography *vu4in* vel *vi4in*, with me.

*au4in* vel *ai4in* with thee.

*ru4in* *ri4in.*

*ku4in* *ki4in.*

*yu4in* *yui4in* (pron. *ivi4in*).

*cu4in* *qui4in.*

*p. 27.* *nu* *Ḥahól* my son, read *nu* *Ḥahól*. *Ḥahól* is he who breaks something.

*nu* *nimial* my elder brother, read *nu* *nimal*.

*p. 30.* *Quis* vel *qui*, *who*? Flores treats this matter in his § 4, pp. 47 and 99, according to his views of the Cakchiquel grammar, as follows:

*Nominative:* *nak* vel *anak* vel *achinak*.

who who who.

*naki* who or what?

*Genet.:* *achok* vel *nakchok*.

whose whose.

*achokychin* *nakchokichin*.

whose whose.

*ahchok* whose.

*Dative:* *nak chirikin* vel *chire*.

to whom.

*nak chiquichin* vel *chique*.

to which of them.

*Accus.:* *nak xacamiçah*.

Whom didst thou kill?

*nak chirih xaḤholihvi*.

With whom didst thou quarrel or fight?

*Ablative:* *nakru4in*, *achokri4in*.

with whom.

*nak rumal*.

by whom, or by what.

QUICUNQUE VEL QUIVIS.

Any one whosoever.

To these correspond the following: *Nak* vel *nakla4a* vel *bilachinak*, and their meaning is any one, whosoever.



v. g. Any one that will not obey, will be punished,  
*nakla mani xtiniman xti4ahiçax ruvach.*

### ALIQUIS.

For aliquis is used the verbal root *4oh* which signifies :  
 to be somewhere (Spanish, *estar*), v. g. *4oh xbano*  
 some one did it. Also, *bila*, *bilanak*, *bilachinak*  
 are used for the *aliquis*, f. i. *vebila x4amo hoyervach*,  
 if some one has taken it, woe to him. *Bilanak* or  
*balanak chi yabilal*, *bilanak chi 8axomal*, some of  
 the infirmities, some of the pains. *Ve bila tux*  
*chivichin ele8on xtirapax*, If some one of you is  
 the thief, he will be whipped.

So far Flores. It is almost superfluous to say that there does  
 not exist anything like declension of interrogative pronouns and  
 the like, and that a future analysis of the above given expres-  
 sions will show in how many respects they thoroughly differ from  
 the Latin *quis*, *quicunque*, *aliquis*, etc.

p. 31. *Distributive words*.—Flores adds (p. 31): "For the  
 distributives of a number they use the particle *ychal*, postponed  
 to the numeral, and the possessive pronoun before it."

CAY, the *y* changed into *b*: *cab*.

*Sing. ru cabichal* both of them.

*Plur. ka cabichal* we both.

*y cabichal* you both.

*qui cabichal* they both.

### OXI.

*Sing. roxichal* all three.

*Plur. koxichal* we }  
*yvoxichal* you } three.  
*coxichal* they }

### CAHI.

*Sing. ru cahichal* all four.

*Plur. ka cahichal* we four.

*y cahichal* you four.

*qui cahichal* they four. And so forth.

p. 32. *nuion*, etc. Flores writes, consistent with the real  
 pronunciation, *nuyon*, *ayon*, etc.

## CHAPT. III. OF THE VERBS.

An exact study of the Maya and Cakchiquel verb would lead us too far at present, and so I am obliged to follow this difficult, but interesting matter according to the system adopted by the old grammarians.

*Sum, es, fui.*

Flores (p. 68) is of opinion that the verb *ux* in some instances means to become, *fio* being a kind of passive of the active verb *ban*, to make, but that there are other instances where it supplants the true verb *sum*, *fui*, *esse*, f. i. in *nak tux*, who is it?

Flores gives the conjugation of the verb *ux* as follows:

*Preterit perfect.*

<i>in</i> $\text{\textcircled{E}}\text{inom xinux}$	I have been rich.
<i>at</i> $\text{\textcircled{E}}\text{inom xat ux}$	Thou hast been rich.
$\text{\textcircled{E}}\text{inom xux}$	
<i>oh</i> $\text{\textcircled{E}}\text{inoma xoh ux}$	etc.
<i>yx</i> $\text{\textcircled{E}}\text{inoma xix ux}$	
<i>he</i> $\text{\textcircled{E}}\text{inoma xe ux}$	

*Future imperfect.*

<i>In</i> $\text{\textcircled{E}}\text{atih xquinux}$	I shall be a teacher.
<i>at</i> $\text{\textcircled{E}}\text{atih xcat ux}$	Thou shalt be a teacher,
$\text{\textcircled{E}}\text{atih xtux}$	etc.
<i>oh</i> $\text{\textcircled{E}}\text{atiha xkoh ux}$	we shall be teachers.
<i>yx</i> $\text{\textcircled{E}}\text{atiha xquix ux}$	
$\text{\textcircled{E}}\text{que ux}$	

It is easy to see that the root *ux* is conjugated according to the rules of the passive verbs, and its present, which no grammarian gives fully, would be *quin-ux*, *cat ux*, *tux*, *koh ux*, *quix ux*, *que ux*. We may even venture to see in the suffix *x* the true sign of a passive verb "to become," and to consider *ux* as the passive of a hypothetical active verb *uh*, to generate, and to translate the above given examples accordingly: I have got rich, I shall become a teacher.

p. 34. *Imperfect preterit.*

*yn naek utz*, I was good. Flores says: "In this idiom there is no special word for the said preterit and for forming it, we

want a temporal sentence: I was good when thou camest. *In utz, tok xatul*, etc." He adds (p. 62), "With less than a temporal sentence the said preterit cannot be expressed, because forming it with *naek* as some Artes MSS. do, is but imperfection, as is shown by the formation of the said particle, the meaning of which is: though, but. Notwithstanding everybody may conform himself with the style of his place."

*Perfect preterit.* Flores forms it with *ux*: *in Xinom xin ux* I have been rich, etc., but he gives also: *in oher ahau* I have been chief.

*Pluperfect.* Flores gives:

	<i>xax in vi</i>	<i>Ξatolkih</i>	I had been judge.
	<i>xax at vi</i>	<i>Ξatolkih</i>	Thou hadst been judge, etc.
and:	<i>in ok utz</i>		I had been good.
	<i>at ok utz</i>		Thou hadst been good.

p. 37. *chuhach* read *chuvach*.

*Optative Mood. Imperfect preterit.* Flores (p. 72) gives:

*In tah naonel quinux* I would be heard or understood.

*Preterit perfect.* Flores (p. 73):

*in tah utz uxinak* I would have been good (*Yo haya sido bueno*).

*Preterit pluperfect.* Flores (p. 74):

*xatavi in utz*, etc. *yo huviera, havria ó huviesse sido bueno*.

*Infinitive Mood.*

Besides the *present* and *imperfect tense*: *in tah utz tivaho* I want to be good, Flores (p. 78) gives the *preterit perfect* and the *pluperfect* as follows:

*Sing. In ta meba xinux can tivaho.*

*yo quisiera haver sido pobre.*

*At ta meba xatux can tavaho.*

*Tu quisieras haver sido pobre.*

*Meba tah xux can tivaho.*

*Plur. oh ta mebay xohux can tikaho.*

*yx ta mebay xixux can tivaho.*

*he ta mebay xeux can ticoho.*

From all the named differences between the old authors in their elaboration of the Cakchiquel paradigm for the verb *sum*, *fui*, *esse*, through all its moods and tenses, the reader will satisfy

himself, that this verb does not form any inherent part of the Cakchiquel, but has been artificially built up by the priests by various particles and circumlocutions.

p. 40. *Indicative Mood of the verb 4oh.*

*Negative preterit imperfect.* Flores (p. 82):

*Tan in mani 4oh*

vel *mani in ta 4oh*, etc.

p. 41. Flores gives a *Preterit perfect*.

*utzta xi4ohe tah, yo haya estado*

*utzta xat4ohe tah, tu hayas estado.*

*Gerunds.* In following up his system, Flores (p. 97) adds what he singularly calls an *Accusative Gerund*, formed with the verb *be to go*.

*quibe 4ohe, voy á estar.*

*catbe 4ohe, vas á estar, etc.*

and an *Ablative Gerund*.

*tan ok in 4oh, estando yo.*

*tan ok at 4oh, estando tú.*

He adds a participle of the present (p. 98): *4ohl, el que está.*

*Pluperfect.*

Were we to adopt for a moment the views of the old grammarians about the Indian verb and to form a pluperfect, it would, with the root *ban* to make, for instance, run thus:

*nu banun chic, I had made.*

(verbally: my making already.)

*a banun chic, Thou hadst made, etc.*

Flores forms it with the verb *loŕon*, to love.

*nu loŕom chic, I had loved.*

The same form *nu loŕom chic* he gives for the Future perfect, I shall have loved, which shows that no such thing as a Future perfect does exist in Cakchiquel.

*yn loŕoninak* (correctly formed from the intransitive verb *loŕon*), I was he who loved.

p. 45. *tivulicah* read *tivuliŕah* I cause to come.

*tivutziricah* read *tivutziriŕah*.

p. 51. *xoŕohauh* read *xokahau*.

p. 55. *oh ahtih*, etc. read *oh ahtiha*, etc.

p. 58. Verbals in *om*. When combined with the possessive pronouns they serve as preterit perfect; *nu banom* I have done.

## p. 59. OF CERTAIN PRONOUNS.

This matter is more extensively treated by Flores (§ XIV, p. 209 sqq. De las oraciones de acusativo) and he gives the following Paradigms:

## PRESENT.

<i>quin a</i>	} lo $\text{E}$ oh	Thou lovest me.
<i>cat nu</i>		I love thee.
<i>ti nu</i>		I love him.
<i>koh y</i>		You love us.
<i>quix ka</i>		We love you.
<i>que ka</i>		We love them.

## PRETERIT.

<i>xin a</i>	} lo $\text{E}$ oh	Thou hast loved me.
<i>xat nu</i>		I have loved thee.
<i>x nu</i>		I have loved him.
<i>xoh ru</i>		He has loved us.
<i>xix ka</i>		We have loved you.
<i>xe ka</i>		We have loved them.

## FUTURE.

<i>xquina</i>	} lo $\text{E}$ oh	Thou shalt love me.
<i>x cat nu</i>		I shall love you.
<i>x ti nu</i>		I shall love him.
<i>xkoh y</i>		You shall love us.
<i>xquix ka</i>		We shall love you.
<i>x que y</i>		You shall love them.

## PRETERIT PERFECT.

<i>in a</i>	} lo $\text{E}$ om	Thou hast loved me.
<i>at nu</i>		I have loved thee.
<i>ha nu</i>		I have loved him.
<i>oh ru</i>		He has loved us.
<i>yx ka</i>		We have loved you.
<i>he y</i>		You have loved them.

Of course, the number of possible combinations between subjective and objective pronoun in the verb is not exhausted by the given examples.

As for combinations of verbs with negative or vetative adverbs, Flores gives the following examples:

## ACTIVE VERB BEGINNING WITH A CONSONANT.

<i>min</i>	}	<i>ban.</i>	no haga yo.
<i>ma</i>			no hagas tú.
<i>mu</i>			no haga el, etc.
<i>maka</i>			
<i>mi</i>			
<i>maqui</i>			

## ACTIVE VERB BEGINNING WITH A VOWEL.

<i>miu</i>	}	<i>a4axah</i> (to hear)	no oiga yo, etc.
<i>mau</i>			
<i>mar</i>			
<i>mak</i>			
<i>miu</i>			
<i>mac</i>			

## ABSOLUTE, PASSIVE AND NEUTER VERB BEGINNING WITH A VOWEL.

<i>min</i>	}	<i>a4axan</i> (absolute) to hear.	
<i>mat</i>			
<i>ma</i> (vel) <i>m</i>			
<i>moh</i>			<i>a4axax</i> (passive) to be heard.
<i>mix</i>			
<i>me</i>			

## VETATIVE ADVERBS FOR IMPERATIVES OF NEUTER, ABSOLUTE AND PASSIVE VERBS BEGINNING WITH A CONSONANT.

<i>min</i>	}	<i>var</i>	to sleep.
<i>mat</i>			
<i>ma</i> (vel) <i>ba</i>			
<i>moh</i>			<i>lo</i> $\text{X}$ <i>on</i> to love.
<i>mi</i> (vel) <i>bi</i>			<i>lo</i> $\text{X}$ <i>ox</i> to be loved.
<i>me</i>			

p. 62. *qu que* to sit down. Better write *quge*. The word is often pronounced cuke and quke.

The system of conjugation in the idioms of Maya origin needs a thoroughly renewed study. The first step will be to examine by a comparative study of the various branches of the Maya family, if the syntactical elements, commonly called verbs, can

really be considered as true verbs. Then we must try to clear them of all the artificial additions of the priests, and to find out the real Indian verb and all its possible forms, tenses and moods, a task by no means so easy as it would seem from a superficial examination. In a subsequent publication, I propose to enter more fully upon this theme.

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*On the Embryology of Limulus polyphemus. III. By A. S. Packard.*

(Read before the American Philosophical Society, January 16, 1885.)

The stage under examination is that represented on figs. 12 and 13, 14 and 15 (Plates iii and iv), of my essay on the development of *Limulus*, Memoirs Boston Society Natural History, 1872. At this stage the oval blastodermic disc, with the six pairs of the cephalic appendages, is distinctly formed; the mouth is seen in a position in front of the first pair of appendages, and from it the primitive streak passes back to the posterior margin of the blastodermic disc or "ventral plate." The abdomen is separated from the head by a curved groove, as seen in fig. 12, of my memoir.

I should here remark that the eggs were not fresh, but selected from a number kindly collected for me in 1871, by Rev. Samuel Lockwood, and since then preserved in alcohol, which had been renewed several times, my studies on the embryology of this animal having been interrupted from year to year, in hopes of obtaining fresh eggs, and for want of good thin sections of those I already had. I finally applied to my friend Dr. C. O. Whitman, whose great experience in making delicate sections was kindly placed at my disposal; the sections examined were actually made by Mrs. Whitman, under the direction of her husband. The period examined is an interesting one, as while the cephalic appendages were well-developed, the abdominal appendages were not as yet indicated, nor the post-oral nervous ganglia.

The first point, which at once excited my attention, was the nature of the embryonic membrane which I had previously regarded as the homologue of the amnion, and afterwards as the serous membrane of insects, but which Mr. J. S. Kingsley\* has found to be secreted from the blastoderm. That he was correct, and that I was in error in regarding it as truly cellular, was at once seen to be evident. A thin section (fig. 1 and 5), shows that the membrane is very thick, structureless, the cellular appearance being confined to the external surface. This membrane is evidently secreted by the blastoderm; the irregular cell-like markings (see my second memoir, 1880, Pl. iii, figs. 14, 14a, 14c, 14d), are, so to speak, casts of the blastoderm cells, which with the marks of even their nuclei are impressed upon the

\* The Development of *Limulus*, Science Record, ii, pp. 249-251, Sept., 1884.